

Research article

Construction of a clinical nursing pathway for acute paraquat poisoning: Evidence-based research

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ABSTRACT

Aim: This study used the Delphi method and clinical expert discussions to develop an acute paraquat poisoning clinical nursing pathway to standardize acute paraquat poisoning nursing care.

Background: In clinical practice, especially in basic-level hospitals, there is no unified standard pattern of treatment and nursing care for patients with paraquat poisoning.

Methods: An extensive literature search was used to gather current clinical guidelines for treating paraquat poisoning which were then compiled into a Delphi expert letter of inquiry questionnaire which was sent to a panel of 12 experts.

Results: A preliminary draft of the clinical nursing pathway table for acute paraquat poisoning with a standard hospitalization period of 21 days was established, with 6, 23, and 152 classes and I, II, and III indicators determined. The clinical nursing pathway table reduced the randomness of work, avoided nursing interruptions or omissions caused by negligence, and simplified the writing of nursing documents.

Conclusions: The clinical nursing pathway can promote and improve the nursing care quality and management efficiency and has good clinical application value.

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1. Introduction

Paraquat poisoning is one of the serious acute conditions that commonly present in the emergency department. Paraquat, a broad-spectrum herbicide, is widely used in rural areas of China due to its low price and quick action. However, poisoning caused by ingestion or misuse occurs from time to time, especially in developing countries [1]. Due to the strong toxicity, patients with paraquat poisoning often have serious illness, rapid progression, multiple organ damage, and high mortality [2].

In clinical practice, especially in basic-level hospitals, there is no unified standard pattern of treatment and nursing care for patients with paraquat poisoning. This results in poor nursing care quality and high mortality. However, since there is no specific antidote to paraquat poisoning, first aid measures include blood purification care, gastrointestinal nursing, diet nursing, and psychological nursing [3]. Hence, paraquat poisoning remains a difficult problem in the field of acute and critical care [4,5]. A previous study has shown that once paraquat poisoning occurs by oral ingestion, even with active treatment, the fatality rate is as high as 50–70% [6].

Currently, great progress has been made in the treatment of paraquat poisoning. A study has shown that the emergency rescue stage is very important in the treatment of paraquat poisoning, and timely and effective clinical treatment can reduce the mortality rate [7]. Therefore, it is very important to strengthen research outputs on acute paraquat poisoning and to implement timely, effective, and standardized treatment.

At present, the clinical nursing pathway that is widely used in clinics can achieve better nursing outcomes among patients with paraquat poisoning. Therefore, based on literature review, this study included clinical expert discussions and utilized the Delphi method to develop an acute paraquat poisoning clinical nursing pathway to standardize acute paraquat poisoning nursing care.

2. Methods

2.1. Subjects

To conduct expert inquiries using Delphi methods, the number of experts can be determined according to the central limit theorem of independent distribution [8]. Under an approximate normal distribution condition, the number of experts considered appropriate, according to the scope of research and research contents, is 8–20 [9]. Based on the above criteria, as well as the manpower, material, and financial resources available for this study, 12 expert reviewers were selected. The selection criteria were as follows: 1) mainly engaged in clinical treatment or nursing work of acute paraquat poisoning; 2) master's degree or above; 3) more than 10 years of work experience; and 4) willingness to participate in this research. The general characteristics of experts are shown in Table 1.

2.2. Methods

2.2.1. Establishing a research group

The clinical nursing pathway research group on acute paraquat poisoning was established according to the department, years of work, educational background, and professional title and position. The group was composed of a department director, head nurse, responsible leader, doctors in charge, and responsible nurse. A total of nine members were included: one with a senior title (responsible for the clinical treatment); one with an associate senior title (responsible for the nursing management); four with intermediate titles and two with junior titles (responsible for clinical nursing); and one graduate student. The team members had a clear division of labor and were proficient in the area of research related to the subject. They were to ensure the scientific feasibility and standardized implementation of the clinical nursing pathway. On the basis of evidence, the research group fully reported and analyzed acute paraquat poisoning information, jointly prepared the draft of the acute paraquat poisoning clinical nursing pathway text, developed expert reviewers' questionnaire, selected expert reviewers, statistically analyzed the review results, and discussed how to modify the acute paraquat poisoning clinical nursing pathway text according to the opinions of the expert reviewers.

Table 1
Basic characteristics of experts (n = 12).

	Project	Number (n = 12)	Percent (%)
Age (years)	~ 30	3	25.00
	~ 40	8	66.67
	~ 50	1	8.33
Education background	Master	8	66.67
	Doctorate	4	33.33
Working years	~ 10	4	33.33
	~ 20	7	58.33
	~ 30	1	8.33
Rank	Middle	1	8.33
	Sub-senior	9	75.00
	Senior	2	16.67
Profession	Doctor	6	50.00
	Nurse	6	50.00

2.2.2. Draft of the pathway

In this study, to construct this clinical nursing pathway text, nursing measures, health education on acute paraquat poisoning, literature review of expert consensus on the diagnosis and treatment of acute paraquat poisoning, and relevant literature on paraquat poisoning, such as clinical pathways and clinical nursing pathways, were used as reference. The databases searched in this study included CNKI, Wanfang, Pubmed, and Springer Open using search terms, such as “Clinical Nursing Pathways”, “Clinical Pathways”, “Nursing”, “Critical Path”, “Paraquat Poisoning”, “Acute Poisoning”, clinical path”, “nursing path”, “clinical nursing path”, “paraquat poisoning”, and “acute poisoning.” We also searched Chinese biomedical literature for relevant expert consensus, systematic evaluation, evidence summary, and clinical guidelines. At the same time, using the snowball method, we retrieved the references of the included literature. The search period was from January 2010 to March 2021 (Supplementary material—Literature screening). We discussed the content of clinical nursing pathways through expert discussion. In order to improve the rigor, practicability, and operability of clinical nursing pathways, six experts with many years of clinical experience in the area of poisoning and occupational diseases in the emergency department were selected to have a discussion. These experts included a chief physician, deputy chief physician, attending physician, deputy chief nurse, and two chief nurses. The experts were asked to provide opinions on the composition of a clinical nursing pathway implementation team, pathway content, intervention methods, and evaluation indicators. On the basis of literature review and discussion with experts, the group discussed the specific steps required for constructing the clinical nursing pathway on acute paraquat poisoning.

2.2.3. Development of the expert reviewers' questionnaire

On the basis of the above draft, a Delphi expert letter of inquiry questionnaire was developed. The content of the questionnaire was divided into three parts. The first part was the explanation of the questionnaire, such as the research purpose and ethical principles. The second part was the main body of the questionnaire, which was composed of items, time, and clinical nursing pathway variation factor records. A “time-item” matrix was designed, and the Likert 5-level scoring method was used to assign the level of importance scores to each item. The third part was on the basic information of the experts, including professional title, educational background, working years, and research fields, as well as the self-evaluation of the experts based on their judgment, degree of influence, and familiarity with all the items set in the questionnaire.

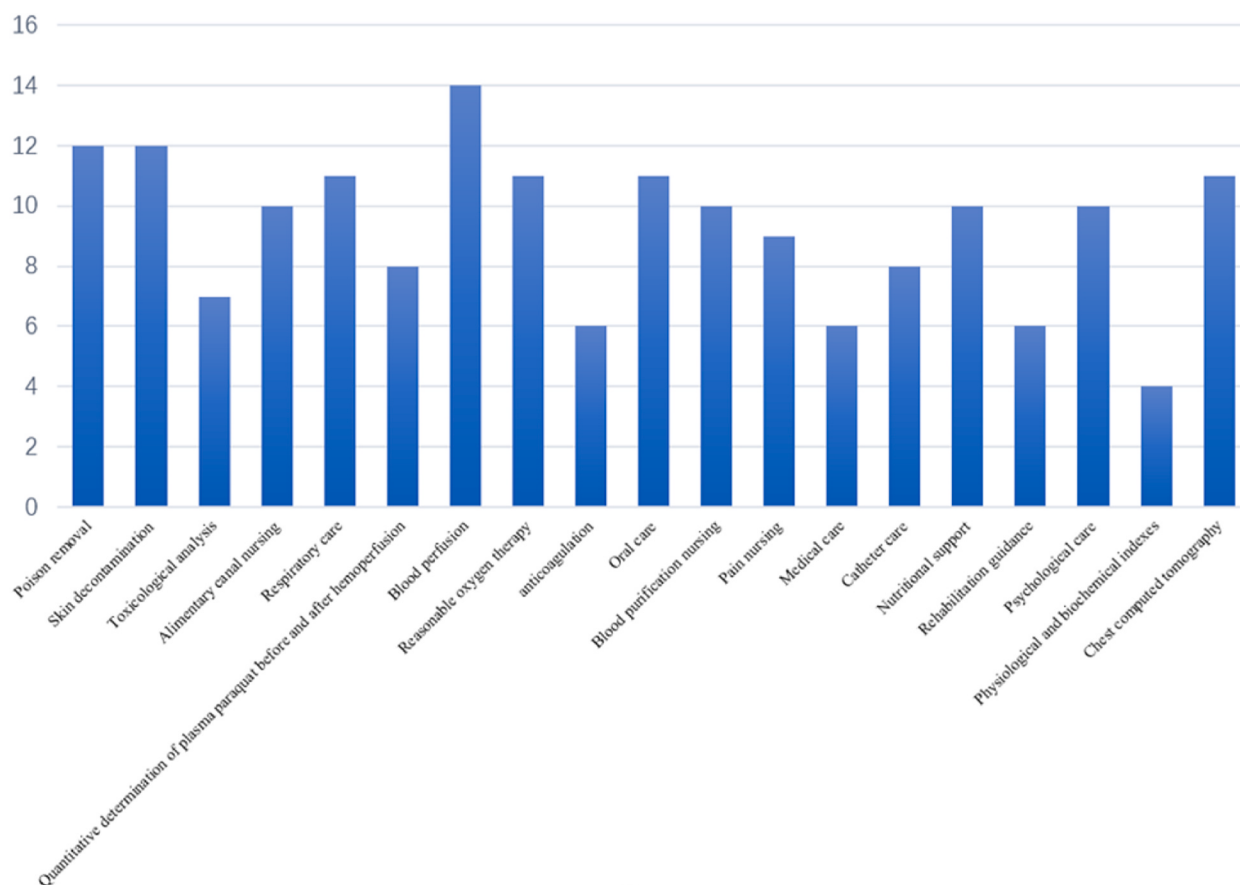


Fig. 1. Nursing contents and frequency of acute paraquat poisoning.

2.2.4. Implementation of an expert consultation

We asked the experts for their opinions by sending emails or delivering the questionnaires in person. After the questionnaires were returned, the research team sorted and analyzed the results of the consultation and screened and modified the items. The principles were as follows: 1) items with a mean score ≥ 4 , coefficient of variation ≤ 0.25 , and expert agreement rate $\geq 75\%$ [10] were retained; 2) decisions regarding whether to add the items proposed by experts to the second round of questionnaire was made after group discussion; and 3) items that were queried by the experts were either deleted or modified after group discussion. With a greater consensus on the process, the expert consultation was concluded; otherwise, a third round of expert review was conducted.

2.3. Statistical methods

The data collected were entered into Microsoft Excel and double-checked, and IBM SPSS Statistics for Windows, version 23.0 (IBM Corp., Armonk, NY, USA) was used for the statistical analysis of the data. $P < 0.05$ indicated a statistically significant difference. Mean $\pm$ standard deviation was used to present the quantitative data in accordance with whether they were normally distributed, and T test and ANOVA were used for single factor analysis. The quantitative data that did not conform to normal distribution are presented as median and interquartile range, and chi-square test and rank sum test were used for their single factor analysis. Qualitative data are expressed as frequency and percentage.

2.4. Ethical consideration

This study has been approved by the Ethics Committee of Qilu Hospital of Shandong University in China (No. KYLL-2019-297).

3. Results

3.1. Literature review results

On the basis of the literature review and according to the retrieval strategy, a total of 2597 articles were retrieved from the above databases. After screening, 30 articles [2,3,5,6,11–36] were finally included, including 22 Chinese and 8 English articles. A review of the literature found that on the basis of active standardized treatment, different outcomes occurred in the course of paraquat poisoning. The vast majority of patients were clinically cured, survived, or died within 21 days, while a small number of surviving patients with local pulmonary fibrosis could also be cured after oral drug treatment [2,6,14]. In summary, combined with expert opinions, we determined that the duration of this study be limited to 21 days. In addition, all surviving patients were followed-up long-term, at 1, 3, 6, and 12 months after discharge following the 21-day hospitalization. After classification, the literature showed 19 types of nursing contents with positive clinical effects mentioned and repeatedly verified. The specific content and frequency of mention are shown in Fig. 1.

3.2. Experts consultations results

The research team conducted a discussion with six experts who had many years of clinical experience in the area of poisoning and occupational diseases in emergency departments. According to the characteristic stage of the disease after paraquat poisoning, six stages were identified as follows: days 1, 2, 3–7, 8–14, 15–21, and the day of discharge. We discussed and identified the specific text content required for constructing the clinical nursing pathway for acute paraquat poisoning. According to different periods, patients or monitoring were required for the assessment of the potential problems, the key points of observation, treatment measure, conventional nursing, nurse, instruction content, auxiliary examination, and follow-up care items, such as first aid and poisoning nursing routine, nursing intervention and health education, auxiliary examination, and follow-up care of four projects. A preliminary draft of the clinical nursing pathway table for acute paraquat poisoning with a standard hospitalization period of 21 days was established, with 6, 23, and 152 classes and I, II, and III indicators determined (Supplementary Table 1). The items were listed in the “project-time” matrix format. The nurse ticks “√” in the “□” before an item that was included, which indicates the date of execution, and signs.

3.3. Experts' positive coefficient

Experts' positive coefficient is the percentage of the total number of experts participating in the evaluation. According to the literature, an experts' positive coefficient greater than 70% is considered a good standard [37]. The response rates in the two rounds of questionnaires are shown in Table 2.

Table 2
Two rounds of questionnaire responses.

Time	Number of expert reviewers	The number of expert reviewer responses	Response rates (%)	Effective rate (%)
One	13	12	100	92.3
Two	12	12	100	100

3.4. Degree of authority of experts

The authority of an expert (Cr) depended on the judgment (Ca) and familiarity (Cs). These two values were derived from the experts' self-assessment. Cr was calculated using the formula: $Cr = (Ca + Cs)/2$. $Cr > 0.7$ represents a high authority of the expert reviewer [38]. In this study, $Cr = 0.79$, indicated that the experts had high authority, as shown in Table 3.

3.5. Degree of coordination of experts

The Delphi technique consultation generally requires two to three rounds of expert coordination [39] and is expressed by the coefficient of variation (CV) and coefficient of coordination (Kendall's W). After the second round of consultation, the coefficient of variation of each round ranged from 0.000 to 0.21 (all <0.25), indicating that the experts had a high degree of coordination for each consultation [38]. The coordination coefficient of the first and second rounds of the questionnaire was 0.329 and 0.430, respectively, with a $P < 0.05$, indicating a good degree of coordination by the experts (Table 4).

3.6. Experts' consultation results

After the end of the first round of experts' consultation, according to the experts' opinions on the consultation and group discussion, individual items of the clinical nursing pathway for acute paraquat poisoning were either deleted or modified. Overall, 2, 15, and 12 items were deleted, modified, and added, respectively. Currently, there are 6, 23, and 162 items in classes I, II, and III indicators, respectively. In the second round of questionnaires, some experts pointed out that "bilateral lower limb venous ultrasound" in the class II index ("Auxiliary examination"), under "15–21 days" was not suitable for patients who had been confirmed to have no thrombosis in a previous examination. According to these experts, it would increase the economic burden of patients; therefore, it was suggested to be deleted. After the group discussion, it was decided that this item be deleted, which was unanimously approved by the 12 experts, to obtain the final clinical nursing pathway table for acute paraquat poisoning (Supplementary Table 2).

4. Discussion

4.1. Scientific research methods

In this study, a literature search was carried out to provide evidence, and literature with high authenticity and reliability was selected for data extraction considering the timeliness and representativeness. Through interviews with clinical experts, the clinical nursing pathway texts for paraquat poisoning were obtained and analyzed. This led to the development of the first draft of the acute paraquat poisoning clinical nursing pathway, which was based on theoretical and practical experience. Hence, the clinical nursing pathway texts were compiled using the Delphi technique that included expert reviewer consultations to ensure evidence-based information and rigor of the study. The Delphi enquiry method involves the research of topics in a field and the selection of consulting experts, using both qualitative and quantitative research methods. Information on the expert's knowledge and experience is obtained through qualitative research, which is then analyzed using statistical analysis methods to finally obtain quantitative results. Anonymous methods are adopted such that the experts can provide independent comments, which when collected together bring out the strengths of all experts. Thereby, the information collected is more comprehensive and extensive than that obtained through other research methods [40]. The Delphi letter inquiry method is one of the most widely used methods in nursing research and has become a recognized and advanced method for index screening and correction [38].

4.2. Reliability of the expert reviewer consultation results

The key to the success of the Delphi expert letter consultation method lies in the selection of the experts. Therefore, in this study, full consideration was given to the selection of experts who participated in the letter consultation study. According to the areas of specialty involved in this study, 12 experts in clinical medicine, nursing, psychology, nursing management, teaching, and scientific research were selected for the consultation. Furthermore, a multidisciplinary assistance team, including those providing medical treatment in nursing and psychological rehabilitation, was established. Among them, all experts had qualifications of master's degree or above, and those with senior professional titles and those who had worked for 20 years or more accounted for 91.67% and 66.67%,

Table 3

Expert reviewers' degree of authority.

Serial number	1	2	3	4	5	6	7	8	9	10	11	12
Judgment coefficient (Ca)	1.0	0.8	0.9	0.9	0.9	1.0	1.0	0.9	0.7	0.7	0.6	0.6
Familiarity (Cs)	0.9	0.9	0.7	0.7	0.9	0.9	0.9	0.7	0.9	0.7	0.3	0.5
Authority coefficient (Cr)	0.95	0.85	0.8	0.8	0.9	0.95	0.95	0.8	0.8	0.7	0.45	0.55

Judgment basis coefficient (Ca) = (sum of 12 expert judgment basis coefficients)/12 = 0.83.

Familiarity coefficient (Cs) = (sum of familiarity coefficients of 12 experts)/12 = 0.75.

Expert authority coefficient (Cr) = 0.79

Table 4
Expert reviewers' coordination degree.

Time	N	CV	Kendall's W	χ^2	P
One	12	0.14	0.329	654.34	<0.01
Two	12	0.07	0.430	856.81	<0.01

N, number; CV, coefficient of variation.

respectively. The positive coefficients in the two rounds of expert consultations were 92.3% and 100%, respectively. The expert authority coefficient (Cr) is an important analysis indicator of the reliability of the Delphi expert consultation method results [41]. The higher the Cr value, the higher the authority of the expert [42]. The Cr in this study was 0.79. Therefore, the sampled consultation experts in this study were authoritative and representative, and the results of the consultation were highly reliable.

4.3. Clinical nursing pathway structure is clear and simple

In the clinical nursing pathway, the texts were listed in the matrix in a “time-item” format, with a clear structure, and the nursing contents included the rules to follow. Thus, the pathway overcame the deficiency due to insufficient knowledge of some nursing staff [43]. The medical care service process was optimized to facilitate the nursing staff implementation according to the established process, which is simple and easy [44]. The clinical nursing pathway table reduces the randomness of work, avoids nursing interruptions or omissions caused by negligence, and simplifies the writing of nursing documents. Therefore, the nurses can devote more time to strengthening communication with their patients, improving consciousness protection, as well as improving compliance of the patients and their families [45]. The pathway promotes and improves the nursing care quality and management efficiency and has good clinical application value; it is also conducive to implementing high-quality nursing services [46].

4.4. Clinical nursing pathway reflects the principle of continuous improvement and individuation of nursing quality

As a standardized and programmed nursing method, the clinical nursing pathway has the characteristics of individuation, timeliness, practicability, and coordination. Nurses are required to have foresight, planning ability, and initiative to conduct continuous and systematic care of patients from admission to discharge. Through health education, patients have a certain understanding of the development, treatment, and outcome of the disease. This promotes the progress of the patient from a passive care receiver to an active, cooperative participant in treatment and nursing care, thus improving the quality of care [47,48]. This evidence-based research, which formed the basis for the clinical nursing pathway table, reflects the common care content, sets up a “variation situation record” (the variations of situations or changes in condition over time), is used to promote group discussions, and summarize records of individual patient situations or individual differences in pertinence. It is also used for the specificity of nursing care, promoting clinical nursing pathway continuous quality improvement, and improving the quality of care [49].

5. Limitations

First, the literature included in this study contained more Chinese literature and less English literature, so there is a certain bias. Secondly, This study only conducted theoretical analysis and expert letter consultation on the clinical nursing pathway and did not carry out practical verification. Therefore, our research group will apply the nursing pathway to clinical practice in the future, and constantly improve it in clinical practice.

6. Conclusions

In summary, the clinical nursing pathway developed in this study was preliminarily constructed on the basis of a literature search and expert consultation. The expert letter consultation was conducted using the Delphi method, which verified its rationality and scientific foundation. However, the effect of its clinical application still needs further study. In the future, our research group aims to apply the clinical nursing pathway for acute paraquat poisoning, constructed in this study, in clinical practice to further explore its role.

Author contribution statement

Ying Lin: Conceived and designed the experiments; Analyzed and interpreted the data; Wrote the paper.

Zixin Wen: Analyzed and interpreted the data; Wrote the paper.

Yanxia Zhang; Jie Shi; Juan Zhang; Xiuqin Li; Tianzi Jian; Yingying Zheng: Performed the experiments.

Xiangdong Jian; Xiaorong Luan; Baotian Kan: Conceived and designed the experiments; Contributed reagents, materials, analysis tools or data.

Data availability statement

Data included in article/supp. material/referenced in article.

Declaration of interest's statement

The authors declare no competing interests.

Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.heliyon.2023.e15447>.

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